

of Claim 1: at least two stacked dies, one die comprising a recessed edge portion along a perimeter, and a second die having bond pads positioned within the recessed edge portion of the first die.

Applicant traverses the claims identified in the non-elected Species groups II, IV and VII, and requests changes to the species groups as follows.

Group I, Species II: Applicant submits that Species II should correctly include Claims 15-22, 51, **120-123**, ~~128-131~~, **140**, ~~142~~ and **145**. (Claims 128-131 and 142 are listed in and should be included in Species IV not II.)

Claims 120-123 recite a die assembly comprising a first die and a second die, wherein the first die has a recess formed therein and the second die disposed within the recess of the first die.

Claim 140 recites the die package of Claim 123.

Claim 145 recites a die assembly of Claim 15.

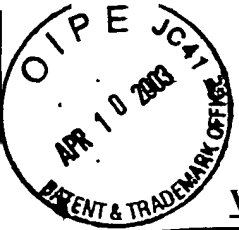
Group I, Species IV: Applicant submits that Species IV should be revised to include Claims 32, 53, ~~120-123~~, 128-131, ~~140~~, 142 and 147. (Claims 120-123 and 140 should be included in Species II — see above.)

Group I, Species VII: Applicant submits that Species VII should be revised to include Claims 39-49, 41-46, 54, 132-136 143 and **148**.

Claim 148 recites the die assembly of Claim 39.

Accordingly, the Examiner is respectfully requested to modify the claims within the identified Species II, IV and VI.

Applicant notes that the election of species is for the purpose of prosecution on the merits, and that Applicant will be entitled to consideration of claims to additional species upon allowance of a generic claim. It is understood that if the claims of the elected Species I are found allowable over the prior art, the Examiner will expand the search to include other species.



Replacement Claims

WHAT IS CLAIMED IS:

1. (currently amended) A stacked die assembly, comprising:
- at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;
- a first die disposed on the first surface of the substrate, and comprising a first surface having ~~a plurality of bond pads located~~ disposed thereon, a second surface, and ~~a first bonding elements~~ connecting the bond pads to the terminal pads on the substrate; and
- a second die comprising a first surface, a second surface, and a perimeter; the first surface having ~~a plurality of bond pads located~~ disposed thereon; the second surface comprising a recessed edge portion along the perimeter of the die; the second die disposed on the first surface of the first die with the bond pads on the first die positioned within the recessed edge portion; the recessed edge portion having a height sufficient for clearance of the ~~first bonding elements~~ extending from the bond pads of the first die.
2. (currently amended) A stacked die assembly, comprising:
- at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;
- a first die disposed on the first surface of the substrate; the first die comprising an active surface having ~~a plurality of bond pads located~~ disposed thereon, an opposing inactive surface, and ~~a first bonding elements~~ connecting the bond pads of the first die to the terminal pads on the substrate; and
- a second die comprising an active surface, an opposing inactive surface, and a perimeter; the active surface having ~~a plurality of bond pads located~~ disposed thereon; the inactive surface having a recessed edge portion along the perimeter of the die; the second die disposed on the active surface of the first die with the recessed edge portion providing an opening over the bond pads of the first die, the opening sufficient for passage of the ~~first bonding elements~~ therethrough.

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3. (currently amended) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a surface having terminal pads ~~located~~ disposed thereon;

a first die disposed on said surface of the substrate; the first die comprising a first surface having a ~~plurality of~~ bond pads ~~located~~ disposed thereon, a second surface, and a ~~first~~ bonding elements connecting the bond pads of the first die to the terminal pads on the substrate; and

a second die comprising a first surface, an opposing second surface, and a perimeter; the first surface having a ~~plurality of~~ bond pads ~~located~~ disposed thereon; the second surface having a thickness removed along the perimeter of the die to provide a recessed edge portion; the second die disposed on the first surface of the first die with the bond pads of the first die ~~located~~ disposed within the recessed edge portion; the recessed edge portion having a sufficient height for clearance of the ~~first~~ bonding elements extending from the bond pads on the first die.

4. (currently amended) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a surface having a ~~plurality of~~ terminal pads ~~located~~ disposed thereon;

a first die disposed on said surface of the substrate; the first die comprising a first side having a ~~plurality of~~ bond pads ~~located~~ disposed thereon, an opposing second side, and a ~~first~~ bonding elements connecting the bond pads of the first die to the terminal pads on the substrate; and

a second die comprising a first side, an opposing second side, and a perimeter; the first side having a ~~plurality of~~ bond pads ~~located~~ disposed thereon; the second side comprising a recessed edge portion along the perimeter of the die; the second die disposed on the first side of the first die with the bond pads of the first die ~~located~~ disposed within the recessed edge portion of the second die, the recessed edge portion having a height sufficient for passage of the ~~first~~ bonding elements from the bond pads of the first die therethrough.

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5. (currently amended) The die assembly of Claim 4, further comprising: ~~a second bonding elements connecting the bond pads of the second die to the terminal pads on the substrate.~~
6. (original) The die assembly of Claim 4, further comprising: at least one of an adhesive element disposed between the first die and the substrate, and an adhesive element disposed between the second die and the first die.
7. (original) The die assembly of Claim 6, wherein the adhesive element comprises a die attach adhesive.
8. (original) The die assembly of Claim 6, wherein the adhesive element comprises a tape adhesive.
9. (original) The die assembly of Claim 4, wherein the second die has at least one of a length and a width greater than the first die.
10. (original) The die assembly of Claim 4, wherein the bonding element comprises a TAB tape.
11. (original) The die assembly of Claim 4, wherein the bonding element comprises a wire bond.
12. (original) The die assembly of Claim 4, wherein the substrate comprises a material selected from the group consisting of bismaleimide triazine resin, epoxy resins, ceramics, and polyimide resins.

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13. (original) The die assembly of Claim 4, wherein the substrate comprises a metal leadframe.
14. (original) The die assembly of Claim 4, being at least partially encapsulated.
15. (currently amended) A stacked die assembly, comprising:
at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having a plurality of terminal pads located disposed thereon, and a second surface;
a first die disposed on the first surface of the substrate, and comprising a first surface and a second surface having a recess formed therein; and
a second die at least partially disposed within the recess of the first die.
16. (currently amended) A stacked die assembly, comprising:
at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having a plurality of terminal pads located disposed thereon, and a second surface;
a first die disposed on the first surface of the substrate through a flip chip attachment, and comprising a first surface and a second surface comprising a recess; and
a second die at least partially disposed within the recess of the first die.
17. (currently amended) A stacked die assembly, comprising:
at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having a plurality of terminal pads located disposed thereon, and a second surface;
a first die disposed on the first surface of the substrate through a flip chip attachment, and comprising a first surface and a second surface comprising a recess; and

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— a second die at least partially disposed within the recess of the first die; the second die comprising a first side having a plurality of bond pads located disposed thereon; and an opposing second side disposed on the first die.

18. (currently amended) The die assembly of Claim 17, further comprising: a bonding elements connecting the bond pads of the second die to the terminal pads on the substrate.

19. (currently amended) The die assembly of Claim 18, wherein the bonding elements comprises one of a wire bond and a TAB tape.

20. (original) The die assembly of Claim 17, further comprising: an adhesive element disposed within the recess between the second die and the first die.

21. (original) The die assembly of Claim 17, wherein the adhesive element comprises one of a die attach adhesive, and a tape adhesive.

22. (original) The die assembly of Claim 17, being at least partially encapsulated.

23. (currently amended) A stacked die assembly, comprising:

a plurality of semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads located disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate, and comprising a first surface and a second surface having a recess formed therein; and

a second die at least partially disposed in the recess of the first die; and

a third die disposed on the second die.

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24. (currently amended) A stacked die assembly, comprising:

a plurality of semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate, and comprising a first surface and a second surface having a recess formed therein; and

a second die at least partially disposed in the recess of the first die, and comprising a first surface having a plurality of bond pads ~~located~~ disposed thereon, an opposing second surface disposed on the first die, and a bonding elements connecting the bond pads of the second die to the terminal pads on the substrate; and

a third die comprising a first surface, an opposing second surface, and a perimeter; the first surface having a plurality of bond pads ~~located~~ disposed thereon; and the second surface comprising a recessed edge portion along the perimeter; the second surface of the third die disposed on the first surface of the second die whereby the recessed edge portion provides sufficient clearance for the first bonding elements extending from the bond pads of the second die.

25. (currently amended) A stacked die assembly, comprising:

a plurality of semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

a first die comprising a first surface disposed on the first surface of the substrate in a flip chip attachment, and a second surface having a recess, the recess having a surface; and

a second die at least partially disposed in the recess of the first die, and comprising a first surface having a plurality of bond pads ~~located~~ disposed thereon, an opposing second surface disposed on the surface of the recess, and a first bonding elements connecting the bond pads of the second die to the terminal pads on the substrate; and

a third die comprising a first surface, an opposing second surface, and a perimeter; the first surface having a plurality of bond pads ~~located~~ disposed thereon, and the second surface

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comprising a recessed edge portion along the perimeter; the second surface disposed on the first surface of the second die whereby the recessed edge portion provides sufficient clearance for the ~~first~~ bonding elements extending from the bond pads of the second die.

26. (original) The die assembly of Claim 25, wherein the recess in the first die is substantially square or rectangular shaped.

27. (original) The die assembly of Claim 25, wherein the recess in the first die is substantially oval or circular shaped.

28. (currently amended) The die assembly of Claim 25, further comprising: a ~~second~~ bonding elements connecting the bond pads of the third die to the terminal pads on the substrate.

29. (original) The die assembly of Claim 25, further comprising: at least one of an adhesive element disposed between the first die and the second die, and an adhesive element disposed between the second die and the third die.

30. (original) The die assembly of Claim 25, wherein the third die has at least one of a length and a width greater than the second die.

31. (original) The die assembly of Claim 25, being at least partially encapsulated.

32. (currently amended) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate; the first die comprising a first surface having ~~a plurality of~~ bond pads ~~located~~ disposed thereon, and an opposing second

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surface having a recess formed therein; the first die attached to the substrate by an adhesive element disposed within the recess; and ~~a first bonding elements~~ connecting the bond pads of the first die to the terminal pads on the substrate; and

a second die disposed on the first surface of the first die.

33. (currently amended) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate; the first die comprising a first surface having ~~a plurality of bond pads located~~ disposed thereon, and an opposing second surface having a recess formed therein; the first die attached to the substrate by an adhesive element disposed within the recess; and ~~a first bonding elements~~ connecting the bond pads of the first die to the terminal pads on the substrate; and

a second die comprising a first surface, an opposing second surface, and a perimeter; the first surface having ~~a plurality of bond pads located~~ disposed thereon; the second surface comprising a recessed edge along the perimeter; and the second die disposed on the first surface of the first die whereby the recessed edge provides sufficient clearance for the ~~first~~ bonding elements extending from the first die.

34. (original) The die assembly of Claim 33, wherein the adhesive element disposed within the recess comprises one of a die attach adhesive, and a tape adhesive.

35. (original) The die assembly of Claim 33, further comprising: a second adhesive element disposed between the first die and the second die.

36. (currently amended) The die assembly of Claim 33, further comprising: ~~a second~~ bonding elements connecting the bond pads of the second die to the terminal pads on the substrate.

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37. (original) The die assembly of Claim 33, wherein the second die has at least one of a length and a width greater than the first die.
38. (original) The die assembly of Claim 33, being at least partially encapsulated.
39. (currently amended) A stacked die assembly, comprising:
at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;
a first die comprising a first surface disposed on the first surface of the substrate, and an opposing second surface; and
a second die comprising a first surface having a plurality of bond pads ~~located~~ disposed thereon, and a second surface having a recess formed therein; the first die at least partially disposed in the recess of the second die.
40. (currently amended) A stacked die assembly, comprising:
at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;
a first die comprising a first surface disposed on the first surface of the substrate in a flip chip attachment, and an opposing second surface; and
a second die comprising a first surface having a plurality of bond pads ~~located~~ disposed thereon, and a second surface having a recess formed therein, the first die at least partially disposed in the recess of the second die.
41. (original) The die assembly of Claim 40, wherein the recess is substantially square or rectangular shaped.

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42. (original) The die assembly of Claim 40, wherein the recess is substantially oval or circular shaped.

43. (original) The die assembly of Claim 40, further comprising an adhesive element disposed within the recess between the first and second dies.

44. (original) The die assembly of Claim 43, wherein the adhesive element comprises one of a die attach adhesive and a tape adhesive.

45. (currently amended) The die assembly of Claim 40, further comprising: ~~a~~ bonding elements connecting the bond pads of the second die to the terminal pads on the substrate.

46. (original) The die assembly of Claim 45, being at least partially encapsulated.

47. (currently amended) A semiconductor die package, comprising the die assembly of Claim 1, further comprising ~~a second~~ bonding elements connecting the bond pads of the second die to the terminal pads on the substrate, and being at least partially encapsulated.

48. (currently amended) The package of Claim 47, further comprising: ~~a plurality of~~ external contacts disposed on the second surface of the substrate.

49. (original) The package of Claim 48, wherein the external contacts comprise a conductive solder, conductive epoxy, or conductor-filled epoxy.

50. (original) The package of Claim 48, wherein the external contacts are in the form of balls, columns, pins, or a combination thereof.

51. (original) A semiconductor die package, comprising the die assembly of Claim 15, being at least partially encapsulated.

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52. (currently amended) A semiconductor die package, comprising the die assembly of Claim 24, further comprising ~~a second~~ bonding elements connecting the bond pads of the third die to the terminal pads on the substrate, and being at least partially encapsulated.

53. (original) A semiconductor die package, comprising the die assembly of Claim 32, being at least partially encapsulated.

54. (currently amended) A semiconductor die package, comprising the die assembly of Claim 39, further comprising a bonding elements connecting the bond pads of the second die to the terminal pads on the substrate, and being at least partially encapsulated.

55-111. (currently cancelled)

112. (currently amended) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate, and comprising a first surface having ~~a plurality of bond pads located~~ disposed thereon, a second surface, and ~~a first~~ bonding elements connecting the bond pads to the terminal pads on the substrate; and

a second die comprising a first surface, a second surface, and a perimeter; the first surface having ~~a plurality of bond pads located~~ disposed thereon; the second surface comprising a recessed edge portion along the perimeter of the die; the second die disposed on the first surface of the first die with the bond pads on the first die positioned within the recessed edge portion; the recessed edge portion having a height sufficient for clearance of the ~~first~~ bonding elements extending from the bond pads of the first die;

means for mounting the first die on the substrate;

means for mounting the second die on the first die; and

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means for connecting the bond pads of the first die to the terminal pads on the substrate.

113. (previously added) The assembly of Claim 112, wherein the mounting means comprises a die attach adhesive, a tape adhesive, or a combination thereof.

114. (previously added) The assembly of Claim 112, wherein the connecting means comprises a wire bond.

115. (previously added) The assembly of Claim 112, wherein the connecting means comprises a TAB tape.

116. (previously added) The assembly of Claim 112, further comprising means for connecting the assembly to an external electrical apparatus.

117. (previously added) The assembly of Claim 116, wherein the assembly connecting means comprises a conductive solder, conductive epoxy, or conductor-filled epoxy, attached to the second surface of the substrate.

118. (previously added) The assembly of Claim 116, wherein the assembly connecting means are in the form of balls, columns, pins, or a combination thereof, attached to the second surface of the substrate.

119. (previously added) The assembly of Claim 112, being at least partially encapsulated to form a die package.

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120. (previously added) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having a plurality of terminal pads ~~located~~ disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate, and comprising a first surface and a second surface having a recess formed therein;

a second die comprising a first side having a plurality of bond pads ~~located~~ disposed thereon, and an opposing second side at least partially disposed within the recess of the first die;

means for mounting the first die on the substrate;

means for mounting the second die in the recess of the first die; and

means for connecting the bond pads of the second die to the terminal pads on the substrate.

121. (previously added) The assembly of Claim 120, wherein the mounting means of the first die comprises a flip chip attachment.

122. (previously added) The assembly of Claim 120, further comprising means for connecting the assembly to an external electrical apparatus.

123. (previously added) The assembly of Claim 120, being at least partially encapsulated to form a die package.

124. (previously added) A stacked die assembly, comprising:

a plurality of semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate, and comprising a first surface and a second surface having a recess formed therein; and

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a second die at least partially disposed in the recess of the first die, and comprising a first surface having a plurality of bond pads ~~located~~ disposed thereon, an opposing second surface disposed on the first die; and

a third die comprising a first surface, an opposing second surface, and a perimeter; the first surface having a plurality of bond pads ~~located~~ disposed thereon; and the second surface comprising a recessed edge portion along the perimeter; the second surface of the third die disposed on the first surface of the second die;

means for mounting the first die on the substrate;

means for mounting the second die in the recess of the first die;

means for mounting the third die on the second die; and

means for connecting the bond pads of the second and third dies to the terminal pads on the substrate.

whereby the recessed edge portion of the third die provides sufficient clearance for the connecting means extending from the bond pads of the second die to the substrate.

125. (previously added) The assembly of Claim 124, wherein the mounting means of the first die comprises a flip chip attachment.

126. (previously added) The assembly of Claim 124, further comprising means for connecting the assembly to an external electrical apparatus.

127. (previously added) The assembly of Claim 124, being at least partially encapsulated to form a die package.

128. (currently amended) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

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a first die disposed on the first surface of the substrate; the first die comprising a first surface having ~~a plurality of bond pads located~~ disposed thereon, and an opposing second surface having a recess formed therein;

a second die disposed on the first surface of the first die.

means for mounting the first die on the substrate, the mounting means disposed within the recess;

means for mounting the second die on the first die; and

means for connecting the bond pads of the first die to the terminal pads on the substrate.

129. (previously added) The assembly of Claim 128, wherein the mounting means of the first and second dies comprises a die-attach adhesive, a tape adhesive, or a combination thereof.

130. (previously added) The assembly of Claim 128, further comprising means for connecting the assembly to an external electrical apparatus.

131. (previously added) The assembly of Claim 128, being at least partially encapsulated to form a die package.

132. (currently amended) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads ~~located~~ disposed thereon, and a second surface;

a first die comprising a first surface disposed on the first surface of the substrate, and an opposing second surface; and

a second die comprising a first surface having ~~a plurality of bond pads located~~ disposed thereon, and a second surface having a recess formed therein; the first die at least partially disposed in the recess of the second die;

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means for mounting the first die on the substrate;
means for mounting the first die in the recess of the second die; and
means for connecting the bond pads of the second die to the terminal pads on the substrate.

133. (previously added) The assembly of Claim 132, wherein the mounting means of the first die to the substrate comprises a flip chip attachment.

134. (previously added) The assembly of Claim 132, wherein the mounting means of the first die to the second die comprises an adhesive element disposed within the recess between the first and second dies.

135. (previously added) The assembly of Claim 134, wherein the adhesive element comprises one of a die attach adhesive and a tape adhesive.

136. (previously added) The assembly of Claim 132, being at least partially encapsulated to form a die package.

137. (previously added) An apparatus, comprising:
an electrical apparatus; and
the die package of Claim 119 in electrical communication with the electrical apparatus.

138. (previously added) The apparatus of Claim 137, wherein the electrical apparatus is selected from the group consisting of a PCB, motherboard, program logic controller, and testing apparatus.

139. (previously added) An apparatus, comprising:
an electrical apparatus; and

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the die package of Claim 119 in electrical communication with the electrical apparatus.

140. (previously added) An apparatus, comprising:
an electrical apparatus; and
the die package of Claim 123 in electrical communication with the electrical apparatus.

141. (previously added) An apparatus, comprising:
an electrical apparatus; and
the die package of Claim 127 in electrical communication with the electrical apparatus.

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B1* 142. (previously added) An apparatus, comprising:
an electrical apparatus; and
the die package of Claim 131 in electrical communication with the electrical apparatus.

143. (previously added) An apparatus, comprising:
an electrical apparatus; and
the die package of Claim 136 in electrical communication with the electrical apparatus.

144. (previously added) A panel substrate, comprising multiple die assemblies according to Claim 1.

145. (previously added) A panel substrate, comprising multiple die assemblies according to Claim 15.

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146. (previously added) A panel substrate, comprising multiple die assemblies according to Claim 24.

147. (previously added) A panel substrate, comprising multiple die assemblies according to Claim 32.

148. (previously added) A panel substrate, comprising multiple die assemblies according to Claim 39.

149. (new) A stacked die assembly, comprising:

at least two semiconductor dies disposed on a substrate in a stacked arrangement; the substrate comprising a first surface having terminal pads disposed thereon, and a second surface;

a first die disposed on the first surface of the substrate, and comprising first and second surfaces, bond pads disposed on the first surface, and bonding elements interconnecting the bond pads and the terminal pads; and

a second die disposed on the first surface of the first die, and comprising first and second surfaces, a perimeter, bond pads disposed on the first surface, and the second surface comprising a recessed edge portion along the perimeter of the die; the bond pads on the first die positioned within the recessed edge portion; the recessed edge portion having a height sufficient for clearance of the bonding elements interconnecting the bond pads of the first die and the terminal pads on the substrate.

150. (new) A stacked die assembly, comprising:

a first die disposed on a substrate, a second die disposed on the first die in a stacked arrangement, and bonding elements interconnecting bond pads disposed on the first die to terminal pads disposed on the substrate, the bonding elements disposed within a recessed edge portion along a perimeter of the second die, the recessed edge portion having a height sufficient for clearance of the bonding elements.

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151. (new) The die assembly of Claim 150, further comprising: bonding elements connecting bond pads disposed on the second die to terminal pads on the substrate.
152. (new) The die assembly of Claim 150, further comprising: an adhesive element disposed on a surface of the first die between the substrate, the second die, or both.
153. (new) The die assembly of Claim 150, wherein the second die has at least one of a length or a width greater than the first die.
154. (new) The die assembly of Claim 150, wherein the substrate comprises a leadframe.
155. (new) The die assembly of Claim 150, being at least partially encapsulated.
156. (new) The die assembly of Claim 150, wherein the first die is attached to the substrate by an adhesive element disposed within a recess within a surface of the die.
157. (new) The die assembly of Claim 150, wherein the first die comprises first and second surfaces, the second die being disposed on the second surface, and the first surface comprising a recess.
158. (new) The die assembly of Claim 157, wherein an adhesive element is disposed within the recess of the first die.
159. (new) The die assembly of Claim 157, wherein a third die is disposed within the recess of the first die.
160. (new) A panel substrate, comprising multiple die assemblies according to Claim 150.

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161. (new) An apparatus, comprising:

an electrical apparatus; and

the die assembly of Claim 150 in electrical communication with the electrical apparatus.

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